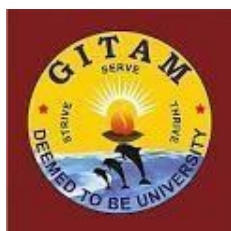


**GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT (GITAM)  
(Deemed to be University)**

**VISAKHAPATNAM\*HYDERABAD\*BENGALURU  
Accredited by NAAC with A<sup>++</sup> Grade**



**REGULATIONS AND SYLLABUS OF  
B.Sc. Medical Lab Technology**

**(W.e.f.2023-24 admitted batch)**

**B.Sc. Medical Lab Technology**  
(Effective from 2023-24 admitted batch)

**ADMISSIONS**

Admissions into B.Sc. Paramedical (Specialization in Medical Lab Technology) program of GITAM (Deemed to be University) are governed by GITAM (Deemed to be University) admission regulations.

**ELIGIBILITY CRITERIA**

**Eligibility:**

Qualified in Intermediate or 10+2 equivalent examinations with 60% Aggregate marks in Physics, Chemistry, Biology and English or APOSS (Open school intermediate) with GPA5.5 or equivalent.

**About the course:**

Our three-year Bachelor of Science in Medical Laboratory Technology (MLT) programme, called Clinical Laboratory Science, educates students with the knowledge and skills necessary to diagnose, treat, and prevent disease using clinical laboratory tests. Students receive training in recognizing, identifying, and treating various ailments. Additionally, they learn how to gather the necessary data, take samples, test them, and write an appropriate, in-depth report for any investigation. The programme is very career-oriented and provides many options for students who want to pursue it as a professional choice in the future.

**Course Administration**

The course is delivered in 6semesters with each semester dealing with prescribed subjects.

- All subjects are mandatory for the student. The student is trained in both theory and practical/clinical aspects of the course. Student is assessed by formative and summative assessment every semester.
- There will be one internal exam before the semester –end exam. Candidates should score A minimum of 35% marks theory and practical internal assessment examination separately to be eligible to appear in the University exam in that subject.
- A candidate shall be declared to have passed in the concerned subject ,if he/she fulfills the Following criteria
  - He/ She secured 35% marks in the internal assessment and
  - (a) He/ She secured 40% marks in theory
  - (b)50% marks in practical & viva
  - (c)50% marks in theory, practical & viva put together in each subject separately.

## **STRUCTURE OF THE PROGRAM**

The Program consists of

- i. Foundation Course (FC)
- ii. Core Courses -Compulsory(C)

Each academic year consists of two semesters. The curriculum structure of the BSC Paramedical program and the contents for various courses offered are recommended by the Board of Studies concerned and approved by the Academic Council.

## **MEDIUM OF INSTRUCTION**

The medium of instruction (including examinations and project reports) shall be English. The method of instruction shall comprise classroom lectures, guest lectures, demonstrations, presentations, role-playgroup discussions, seminars, class tests, case analysis, situational analysis, practical training, etc.

## **ATTENDANCE REQUIREMENTS**

- A candidate must have not less than 75% attendance in theory and 80% in practicals separately.
- Candidates should score a minimum of 35% marks theory and practical internal assessment examination separately to be eligible to appear in the University exam in that subject.
- There will be one internal exam before the semester- end exam.
- Internal marks will be considered for eligibility for the semester exam but will not be added for the semester exam.

## **EVALUATION:**

### **CONTINUOUS ASSESSMENT AND EXAMINATIONS**

- There will be one internal exam before the semester –end exam.
- Candidates should score a minimum of 35% marks theory and practical internal assessment examination separately to be eligible to appear in the University exam in that subject.
- Internal marks will be considered for eligibility for the semester exam but will not be added for the semester exam.

### **EXAMINATION DURATION AND PATTERN**

- a. Anatomy, Biochemistry, Physiology, Microbiology, Pathology, Pharmacology, Community medicine & Parent Department- 100 marks each

Theory : 60marks

Practical : 40 marks (Practical: 30marks+ Viva-voce: 10marks)

- b. English, EVS, Computer- 40 marks each

Theory : 40 marks

- c. Pattern of question paper

60 marks paper (Duration: 2 ½ Hours)

1 Q Essay (1x10m = 10 marks)

2Q to 5Q Short notes (total 4 Q, 4x5 m= 20 marks)

6Q to 15 Q very short notes (total 10 Q, 10 x3m=30marks)

40marks paper (Duration: 2hours)

1Q Essay question (1x10m=10marks)

2Q to 4 Q Short notes (3 Q x5 =15marks)

5Q to 9 Q Very short notes (5 Q x3 m = 15marks)

### **PAPER SETTING**

Paper setting, paper valuation and practical examination is done by internal examiners from the I to VI semesters.

### **CRITERIA FOR EXAMINER**

- Professor or Associate Professor or Assistant Professor with minimum of 2years of teaching experience after post-graduation is eligible to be as examiners.

**Grace Marks:** Maximum 5 marks can be awarded to one subject provided he/she passed all the other subjects or these 5 marks can be split for maximum 2 subjects. Provided the candidate has passed rest of the subjects.

**A candidate shall be declared to have passed the examination if...**

(a) He / She secured 40% marks in theory.

(b) 50% marks in practical & viva

(c) 50% marks in theory, practical & viva put together in each subject separately.

## PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

<b>PEO1</b>	To impart knowledge and skill in accordance with the requirement in basic medical sciences and paramedical specialty as relevant.
<b>PEO2</b>	To impart training required to carry out necessary investigative procedures accurately to facilitate proper diagnosis and prognosis of diseases.
<b>PEO3</b>	To train the student to perform routine as well as special investigative procedures in the concerned paramedical specialty.
<b>PEO4</b>	To impart knowledge and practical training required to operate and maintain all equipment used in the concerned specialization.
<b>PEO5</b>	To impart knowledge about communication skills, basic research skills, professionalism, and ethical aspects required in various healthcare settings for effective delivery of health care.

## PROGRAMME OUTCOMES (POs)

<b>PO1</b>	To prepare a cadre of healthcare technologists who can effectively assist senior health professionals in the delivery of quality health services.
<b>PO2</b>	To prepare skilled paramedical human resources for all levels of the healthcare delivery system from primary to tertiary cadre level.
<b>PO3</b>	To train the students to carryout necessary procedures accurately and to facilitate proper diagnosis and prognosis of diseases.
<b>PO4</b>	To enable to perform routine as well as special investigative procedures in the concerned paramedical specialty.
<b>PO5</b>	To develop knowledge and skill in accordance with the demand in the field of Paramedical specialty as applicable.
<b>PO6</b>	To enable to operate and maintain all types of equipment used in the concerned Specialization.
<b>PO7</b>	To be capable to support advanced testing activities and Research.
<b>PO8</b>	To enable to work as Supervisor/Trainer/Teacher in the field of Paramedical Sciences.
<b>PO9</b>	To enable to communicate and interact effectively with non-clinical and clinical persons in various healthcare environments.
<b>PO10</b>	To be able to present oneself in an ethical and professional manner.
<b>PO11</b>	To equip the paramedical staff with modern skills and knowledge to bring them at par with other national and international standards.
<b>PO12</b>	Students who complete these programs will be able to work in both an individual and team environment.

## PROGRAM SPECIFIC OUTCOMES (PSOs)

At the end of course, the students will be able to:

<b>PSO-1</b>	Perform routine clinical laboratory testing.
<b>PSO-2</b>	Make specimen-oriented decisions on predetermined criteria including working knowledge of critical values
<b>PSO-3</b>	Communicate with other members of healthcare team, customers, and patients in an effective manner.
<b>PSO-4</b>	Process information and ensure quality control as appropriate to routine laboratory procedures
<b>PSO-5</b>	Train students in routine laboratory procedure.
<b>PSO-6</b>	Upgrade knowledge and skills in a changing healthcare scenario.
<b>PSO-7</b>	Should know the logical interpretation of clinical lab investigations.
<b>PSO-8</b>	Should be able to extrapolate data acquired. Should be able to work on automated machine.

## STRUCTURE OF THE PROGRAMME:

<b>B.Sc. Medical Lab Technology</b>									
<b>Semester - I</b>									
Sl.N o.	Subject Code	Subject	Hours			Credits			Cat
			Theory	Practical/ Clinical	Total	Theory	Practical/ Clinical	Total	
1	23ANAT1001	Anatomy - I	30	15	45	2	0.5	2.5	C
2	23PSGY1001	Physiology - I	30	30	60	2	1	3	C
3	LANG1141	English	30		30	2		2	FC
4	CSCI1301	Computer Basics	30		30	2		2	FC
5	ENVS1051	Environmental Science	15		15	1		1	FC
6	23PATH1011	Basic Laboratory, Orientation and Safety		300	300		10	10	C
<b>Total</b>			<b>135</b>	<b>345</b>	<b>480</b>	<b>9</b>	<b>11.5</b>	<b>20.5</b>	
<b>Semester – II</b>									
1	23ANAT2001	Anatomy - II	30	30	60	2	1	3	C
2	23PSGY2001	Physiology - II	60	30	90	4	1	5	C
3	23PATH2011	Clinical Laboratory Practices	45	315	360	3	10.5	14	C
<b>Total</b>			<b>135</b>	<b>375</b>	<b>510</b>	<b>9</b>	<b>12.5</b>	<b>21.5</b>	
<b>Semester – III</b>									
1	23BCHE1011	Biochemistry – I (Basics in Biochemistry)	30	150	180	2	5	7	C
2	23MIBG1001	Microbiology – I (General Microbiology & Immunology)	30	150	180	2	5	7	C
3	23PATH1001	Pathology – I (Hematology & Clinical Pathology)	30	150	180	2	5	7	C
<b>Total</b>			<b>90</b>	<b>450</b>	<b>540</b>	<b>6</b>	<b>15</b>	<b>21</b>	
<b>Semester – IV</b>									
1	23BCHE2001	Biochemistry – II (Metabolisms)	30	150	180	2	5	7	C
2	23MIBG2001	Microbiology – II (Systemic Bacteriology)	30	150	180	2	5	7	C
3	23PATH2001	Pathology – II (Histopathology & Cytology)	30	150	180	2	5	7	C
<b>Total</b>			<b>90</b>	<b>450</b>	<b>540</b>	<b>6</b>	<b>15</b>	<b>21</b>	
<b>Semester – V</b>									
1	23BCHE3001	Biochemistry – III (Clinical & Applied Biochemistry)	30	150	180	2	5	7	C
2	23MIBG3001	Microbiology – III (Virology & Mycology)	30	150	180	2	5	7	C
3	23PATH3001	Pathology – III (Advanced Techniques)	30	150	180	2	5	7	C

			<b>90</b>	<b>450</b>	<b>540</b>	<b>6</b>	<b>15</b>	<b>21</b>	
<b>Semester – VI</b>									
1	23BCHE3011	Biochemistry – IV (Recent techniques in Biochemistry)	30	150	180	2	5	7	C
2	23MIBG3011	Microbiology – IV (Parasitology)	30	150	180	2	5	7	C
3	23PATH3011	Pathology –IV (Blood Banking)	30	150	180	2	5	7	C
			<b>90</b>	<b>450</b>	<b>540</b>	<b>6</b>	<b>15</b>	<b>21</b>	
<b>Total</b>								<b>126</b>	



# **SEMESTER - I**

## **ANATOMY – I**

**23ANAT1001**

### **INTRODUCTION:**

Anatomy deals with the structural organization of the human body. Anatomy forms the basis for the practice of medicine. Students need core knowledge of human anatomy as they venture into the clinical domain. The department of anatomy is committed to providing quality education for students by its fully-equipped facilities. Cadaveric dissections & specimens, histology slides, and VARIOUS models provide the ideal environment to learn anatomy during the 1<sup>st</sup> year of their course.

### **COURSE OBJECTIVES:**

- The objective of this subject is to provide an outline of anatomy to improve the students' understanding of the technical and diagnostic procedures used, with special emphasis on applied aspects.

### **SYLLABUS**

**Credits: Theory 02 & Practical 0.5**

**Hours: Theory 30 & Practical 15**

<b>UNIT</b>	<b>CONTENT</b>	<b>No. OF HOURS</b>
I	Introduction to anatomical terms and organization of the human body Introduction to anatomical terms relative to position – anterior, ventral, posterior dorsal, superior, inferior, median, lateral, proximal, distal, superficial, deep, prone, supine, palmar and plantar Anatomical planes (axial/ transverse/horizontal, sagittal/vertical plane and coronal/frontal/oblique plane) Movements (flexion, extension, abduction, adduction, medial rotation, lateral rotation, inversion, eversion, supination, pronation, plantar flexion, dorsal flexion and circumduction Cell structure, Cell division, Tissue - definition, types, characteristics, classification, location Hyaline, fibro cartilage, elastic cartilage, Histology of Bone, Features of skeletal, smooth and cardiac muscle.	5
II	The Respiratory system Structure of the organs of respiration, Pleura, Morphology of Lungs, Broncho Pulmonary Segments, Histology of Lungs	5
III	Cardiovascular system Morphology of Heart, Internal features of Heart – right atrium and right ventricle Chambers & Openings of the heart, Types of Circulation, Coronary Circulation, Aorta and its branches	8

IV	Muscular system types of muscles Muscles of Upper Limb, Muscles of back, diaphragm, Muscles of arm, Muscles of Forearm Significance of Deltoid Muscle, Muscles of Lower Limb, Muscles of thigh, Muscles of Leg	5
V	Muscular system types of muscles Muscles of Upper Limb, Muscles of back, diaphragm, Muscles of arm, Muscles of Forearm, Significance of Deltoid Muscle, Muscles of Lower Limb, Muscles of thigh, Muscles of Leg Significance of Gluteus Maximus Muscle, Blood vessels of Upper Limb : Arm- Axillary artery, brachial artery forearm - Radial artery, ulnar Artery, medial cubital vein, Blood vessels of Lower Limb : Thigh femoral artery, popliteal artery	7

**Practical:**

UNIT	CONTENT	No. OF HOURS
I	Microscopy, Histology of tissues – cartilage, Bone and Lung	2
II	Inter costal space, Heart, Lungs	3
III	Upper Limb – Bones, Muscles, Auxiliary artery, brachial artery, fore Arm - Radial artery, ulnar Artery, medial cubital vein, Nerves : Axillaries Nerve , Median Nerve, Ulnar Nerve, radial Nerve	4
IV	Lower Limb – Bones, Muscles, Thigh femoral artery, popliteal artery Nerves of Lower Limb: Femoral Nerve, Sciatic Nerve, Obturator Nerve	4
V	Normal X- Rays, Surface markings	2

**Course Outcomes:**

- Explains knowledge on the basic anatomy of various regions like limbs, thoracic and abdominal viscera, osteology, neuro anatomy, endocrine system, basic radiology which provides a foundation in completion of the course.
- Explain the anatomy and functions of various Tissues and cells, an organization of a cellular system.
- Understand the functioning of lungs, heart, and blood vessels.

**References:**

1. B D Chaurasia :Handbook of general anatomy
2. Text book of Anatomy &Physiology by InduKhurana&Arushi
3. Textbook of Anatomy & Physiology by PR Ashalatha&G Deepa
4. Textbook of Anatomy&Physiology by Ashalatha N Nandedkar, Vijay D Joshi&Sadhana– 3<sup>rd</sup>edition

**DEPARTMENT OF PHYSIOLOGY**

**23PSGY1001 - PHYSIOLOGY - I**

**(2023-2024 BATCH)**

**INTRODUCTION**

Physiology is the study of functions and mechanisms in a living system. Physiology focuses on individual organs, cells, and bio molecules carrying out the chemical and physical functions in a living system. The physiological state is the condition of normal function, while the pathological state refers to abnormal conditions, including human diseases.

**Course Objective**

- Understand the basic physiological functions of different organs and parts of the human body and important applied aspects.

**SYLLABUS**

**Credits: Theory 02 & Practical 1**

**Hours: Theory 30 & Practical 30**

THEORY	CONTENT	No. OF HOURS
<b>UNIT - I</b>		
Cell Physiology	Describe the structure and functions of cell, Describe the functions of the cell organelles, and Describe briefly the types of transport across cell membrane and carrier systems.	3
Immunity	Define immunity and describe the types of immunity, Classify antigen & antibodies Describe T cell immunity & B cell immunity	2
<b>UNIT - II</b>		
Blood Physiology	Describe the normal composition of human blood and its functions Describe the normal plasma proteins & their functions Describe the structure and functions of RBC and hemoglobin Describe the process of Erythropoiesis Describe the Structure, production, & functions of WBCs Describe the structure, production & functions of Platelets Describe the Types of blood groups and their importance, Describe the Mechanism of coagulation	8
<b>UNIT - III</b>		
Digestive System	Describe briefly the Physiological anatomy of G.I.T and its functions. Describe briefly the composition and functions of Saliva Describe briefly the physiological anatomy of the stomach and the composition, functions of gastric juice. Describe briefly the functions of pancreas, and the composition & functions of pancreatic juice.	7

	Describe briefly the functions of liver and gall bladder and the Composition, and functions of bile juice	
<b>UNIT - IV</b>		
Respiratory System	Describe the physiological structure and functions of Respiratory tract. Describe the Mechanics of respiration and its regulation Describe the Fundamentals of oxygen and CO <sub>2</sub> transport in blood Describe the lung volumes, spirometry & their importance	5
<b>UNIT - V</b>		
Cardiovascular System	Describe the gross structure of heart and the normal circulation of blood Describe the cardiac cycle Describe the normal arterial pulse wave and the normal heart rate, and factors increasing and decreasing it. Describe normal Blood pressure and its regulation, Describe the normal Heart sounds Describe the normal ECG and its importance	5
<b>PRACTICAL</b>	<b>CONTENT</b>	<b>No. OF HOURS</b>
<b>UNIT – I</b>	Estimate Hemoglobin in given blood sample, Estimate bleeding time & clotting time	8
<b>UNIT – II</b>	Measure ESR of given blood sample, Perform RBC count of given blood sample	8
<b>UNIT – III</b>	Perform WBC count of given blood sample Perform a differential WBC count of the given sample	4
<b>UNIT – IV</b>	Calculation of blood indices, Determination of Blood Groups	4
<b>UNIT – V</b>	Measure pulse rate, heart rate, Measure BP, respiratory rate & temperature	6

### Course Outcomes:

- Explain the anatomy, physiology and functions of various Tissues and cell, organization of cellular system.
- Explain Hematopoietic and lymphatic system homeostatic and its altered physiology.
- Explain the anatomy and Physiology of the cardiovascular and respiratory system and its disorders.
- Explain the anatomy and Physiology of digestive, urinary, and reproductive systems and their disorders.
- Describe the Physiology of muscle contraction and its disorders.

### References:

- Textbook of physiology for BDS AK Jain 6th edition
- Textbook of physiology for BDS Sembulingam 3rd edition
- Physiology in nutshell by AK Jain 5th edition

**ENGLISH – LANG1141**  
(Effective from the admitted batch 2023-24)

**INTRODUCTION:**

The course is a unified approach to enhance language skills of learners with an aim to hone their social skills and to increase their employability. The course is designed to acquaint the learners with the necessary LSRW (Listening/ Speaking / Reading/ Writing) skills. It enables the learners improve their communication skills which are crucial in an academic environment as well as professional and personal lives.

**COURSE OBJECTIVES**

- Understand and communicate in simple English, written and verbal
- Understand and practice the basic principles of English grammar
- Comprehend and summarize a given English essay/paragraph
- Understand common English terms used in the medical/health care field

**SYLLABUS**  
**Credits: 02 & Hours:30**

<b>THEORY</b>	<b>CONTENT</b>	<b>No. OF HOURS</b>
<b>UNIT - I</b> Prescribed Prose	1. Leo Tolstoy: How much land does a man need? 2. O' Henry: The Last Leaf 3. Frank Stockton: The Lady or the Tiger	3
<b>UNIT - II</b> Prescribed Poetry	1. William Shakespeare: The Seven Ages of Man 2. Robert Frost: The Road not Taken 3. John Milton: On his Blindness	3
<b>UNIT – III</b> Basic English Grammar	Grammar - 8 parts of speech. Structure of sentence. Sentence writing. Paragraph writing. Summarizing / precis writing. Reading & comprehension (a small paragraph followed by questions).	4
<b>UNIT – IV</b>	General English Vocabulary & Use of dictionary Common Medical Terminology Spoken & Written English	2 2 2
<b>UNIT – V</b>	Listening & Reading skills English comprehension & summarizing & inference Writing skills - Questions based on prescribed prose/ poetry, letter, Summary, Medical Report, Documentation, Case history, Note taking Verbal communication - discussion & summarizing. Taking minutes of meeting.	2 2 8 2

### **Course Outcomes**

- By the end of the course, the learners will be able to:
- Think critically, analytically, creatively and communicate confidently in English in social and professional contexts with improved skills of fluency and accuracy.
- Write grammatically correct sentences employing appropriate vocabulary suitable to different contexts
- Comprehend and analyze different academic texts.
- Make notes effectively and handle academic writing tasks such as Paragraph writing and Essay writing.
- Effectively handle formal correspondence like e-mail drafting and letter writing.

### **Reference Books:**

- Arosteguy, K.O. and Bright, A. and Rinard, B.J. and Poe, M. A Student's Guide to Academic and Professional Writing in Education, UK, Teachers College Press,2019
- Raymond Murphy, English Grammar in Use A Self-Study Reference and Practice Book for Intermediate Learners of English: Cambridge University Press;2019
- Peter Watkins, Teaching and Developing Reading Skills: UK, CUP, 2018
- Deeptha Achar et al. Basic of Academic Writing. (1 and 2) parts New Delhi: Orient Black Swan.(2012&2013).
- Kumar S and Lata P, Communication Skills: New Delhi Oxford University Press,2015

## BASICS OF COMPUTERS

CSCI1301

### Introduction:

Computer science spans theoretical disciplines (such as algorithms, theory of computation, and information theory) to practical disciplines (including the design and implementation of hardware and software). It deals with concepts regarding the architecture of a computer, common application software and uses of computers in everyday life.

### Course Objectives:

To build necessary concepts regarding the architecture of a computer

To develop an understanding of the common application software.

To understand the uses of computers in everyday life.

## SYLLABUS

Credits: 02 & Hours:30

UNIT	CONTENT	HOURS
I	<ol style="list-style-type: none"><li>1. Describe and identify the principal components of a computer</li><li>2. Define the various terms used in computer – hardware/software / operating system</li><li>3. Describe the functions and uses of computers including in health care</li></ol>	5
II	<ol style="list-style-type: none"><li>1. Mention the common types of files including Word documents, Spreadsheets (Excel) and Presentations (PowerPoint) and their uses</li><li>2. Basic Network connecting</li><li>3. Explain the uses of the internet and email</li><li>4. Collaborative work using Google suite of applications / Microsoft Office 365</li></ol>	5
III	<ol style="list-style-type: none"><li>1. Demonstrate use of a computer for common purposes</li><li>2. Demonstrate methods for Data storage &amp; retrieval and making folders;</li><li>3. Perform functions like date/time setting or changing, change display settings, Installing /removing programs etc.</li><li>4. Understand and Use MS Word / Word Document program</li><li>5. Prepare a properly formatted, spell-checked document in Word Document including insertion of images and tables and take a print-out/mail as an attachment, and convert to Pdf. (portable document format)</li><li>6. Understand and Use MS Excel / Data spreadsheet</li><li>7. Prepare a proper Excel document (spreadsheet) with given data and sort out data, insert / delete cells, etc., use formula bar for common functions like calculate mean etc, convert to pictorial format like bar / pie diagram, etc.</li><li>8. Prepare and use computer-based presentations like PowerPoint with appropriate fonts and colors including insertion of images, videos etc.</li></ol>	10
IV	<ol style="list-style-type: none"><li>1. Prepare an appropriate file like excel to enter patient data and retrieve it</li><li>2. Use the facility of Mail Merge between Excel to a Word document</li><li>3. Sending customized email to selected members.</li><li>4. Prepare a patient report and take a print out</li></ol>	5
V	<ol style="list-style-type: none"><li>1. Prepare a database of patient info and lab results for storage and later retrieval</li><li>2. Communicate by e-mail including opening email account</li><li>3. Demonstrate use of search engines / Google search etc. for academic information</li></ol>	5

### Learning Outcomes:

At the end of the training program, the student would be able to

- Classify various components of the computer.
- Experiment with the various application software of Microsoft Office suite.
- Make use of collaborative applications over the internet

**Course Outcomes:**

At the end of the course student is expected to

1. Know about the concept and architecture of a computer.
2. To understand the common application software.
3. To understand and apply the uses of computers in everyday life.

**References –**

1. Introduction to Computers by Peter Norton (McGraw Hill Education)
2. Mastering Excel: A Problem-Solving Approach by James Gips (John Wiley and Sons)
3. SAMs Teach Yourself Computer Basics in 24 hours



## ENVIRONMENTAL SCIENCE

### ENVS1051

#### **Introduction:**

The course enables the students to adapt eco-centric thinking and actions rather than human-centric thinking on natural resources, their utilization and conservation. The course also focuses on the importance of ecosystems, biodiversity and their degradation led to pollution. This course helps in finding solutions through application of control measures to combat pollution and legal measures to achieve sustainable development.

#### **Course Objectives :**

- To impart knowledge on natural resources and its associated problems.
- To familiarize learners about ecosystem, biodiversity, and their conservation.
- To introduce learners about environment pollution.
- To acquaint learners on different social issues such as conservation of water, green building concept.
- To make learners understand about the present population scenario, its impacts and role of informational technology on environment and human health.
- To make learners understand about the importance of field visit.

### SYLLABUS

**Credits: 01 & Hours: 15**

UNIT	CONTENT	HOURS
<b>UNIT – I</b> Multidisciplinary nature of environmental studies:	Definition, scope and importance. Need for public awareness.	01
<b>UNIT – II</b> Natural Resources	Natural resources and associated problems. Forest resources: Use and over-exploitation, deforestation, timber extraction. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits, and problems. Mineral resources: environmental effects of mining. Food resources: World food problems, overgrazing, fertilizer-pesticide problems. Energy resources: use of alternate energy sources. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.	03
<b>UNIT – III</b> Environmental pollution	Definition Causes, effects, and control measures of: Air pollution. Water pollution. Soil pollution. Thermal pollution. Solid waste Management: Causes, effects, and control measures of urban and industrial wastes. Cyclone, and landslides; Role of an individual in prevention of pollution.	03

<p style="text-align: center;"><b>UNIT – IV</b> <b>Ecosystem and biodiversity</b></p>	<p><b>Ecosystem:</b> Structure components of ecosystem: Biotic and Abiotic components. Functional components of an ecosystem: Food chains, Food webs, Ecological pyramids, Ecological succession. Introduction, types, structure and function of Forest ecosystem. Aquatic ecosystems (ponds, streams, lakes, rivers).</p> <p><b>Biodiversity:</b> Definition, genetic, species and ecosystem diversity. Biogeographically classification of India, Values of biodiversity: consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega – diversity nation. Hot-spots of biodiversity. Threats to biodiversity, Conservation of biodiversity.</p>	03
<p style="text-align: center;"><b>UNIT – V</b> <b>Social issues and Environmental legislation</b></p>	<p>From Unsustainable to Sustainable development Urban problems related to energy. Water conservation, rainwater harvesting and watershed management. Resettlement and rehabilitation of people; its problems and concerns related Environmental ethics.</p> <p>Role of Information Technology in Environment and human health.</p> <p>Environment Legislation. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Environmental Protection Act, Issues involved in enforcement of environmental legislation. Public awareness.</p>	05
<p><b>Pedagogy tools:</b> Blended learning, Case let, video lectures, self-reading</p>		
<p><b>Text Book(s):</b></p> <ol style="list-style-type: none"> <li>1. Erach Bharucha. Textbook of environmental studies for undergraduates courses-Universities Press, India Private Limited. 2019.</li> <li>2. Kaushik A and Kaushik C.P. Perspectives in Environmental Studies. New Age International Publishers Edition-VI. 2018.</li> <li>3. Dave D Katewa S.S. Textbook of Environmental Studies, 2<sup>nd</sup> Edition. Cengage Learning India. 2012.</li> </ol> <p><b>Additional Reading</b></p> <p>Benny Joseph. Textbook of Environmental Studies 3<sup>rd</sup> edition, McGraw Hill Publishing company limited. 2017.</p> <p><b>Reference Book(s):</b></p> <ol style="list-style-type: none"> <li>1. McKinney M.L., Schoch R.M., Yonavjak L. Mincy G. Environmental Science: Systems and Solutions. Jones and Bartlett Publishers. 6<sup>th</sup> Edition. 2017.</li> <li>2. Botkin D.B. Environmental Science: Earth as a Living Planet. John Wiley and Sons. 5<sup>th</sup> edition. 2005.</li> </ol> <p><b>Journal(s):</b></p> <p><a href="https://www.tandfonline.com/loi/genv20">https://www.tandfonline.com/loi/genv20</a></p> <p><a href="https://library.lclark.edu/envs/corejournals">https://library.lclark.edu/envs/corejournals</a></p> <p><b>Website(s):</b></p> <p><a href="https://www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf">https://www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf</a></p>		

**Learning Outcome:**

List different natural resources and their uses.
Relate how the over-exploitation of natural resources impact human life
Find the role of an individual in the conservation of natural resources.
Recall the demand of potable water in a community.
Explain the equitable use of natural resources for sustainable lifestyles.
Demonstrate how ecosystem functions.
Summarize the structure and function of terrestrial and aquatic ecosystems.
Explain the values and threats to biodiversity.
Identify the importance of conservation of biodiversity.
Identify causes, effects, and control measures of pollution (air, water & soil).
Improve wasteland reclamation.
Analyze the role of an individual in prevention of pollution.
Solve disaster management issues of cyclone, and landslides.
Examine different water conservation methods.

**BASIC LABORATORY ORIENTATION AND SAFETY**

**23PATH1011**

**LABORATORY POSTINGS -HOURS -300; CREDITS – 10**

<b>UNIT</b>	<b>TOPICS</b>	<b>HOURS</b>
<b>I</b>	<b>Laboratory Services:</b> levels of laboratories – Primary level, Secondary level and tertiary level. Reference laboratories, Research laboratories and specific disease reference laboratories	50
<b>II</b>	<b>Standard precautions</b> <ul style="list-style-type: none"><li>• Hand hygiene</li><li>• PPE</li><li>• Spill management</li><li>• Dealing with the sharps (NSI)</li><li>• Bio-waste management</li></ul>	90
<b>III</b>	<b>Transmission based precautions</b>	40
<b>IV</b>	<b>Safety in Laboratories:</b> General safety measures, bio safety precautions, levels of bio safety laboratories: BSL1, BSL2, BSL3, BSL4	40
<b>V</b>	<b>Accidents and emergencies in the laboratory</b>	40
	<b>Disinfection protocols in the laboratory</b>	40

## SEMESTER – II

### ANATOMY – II

#### 23ANAT2001

#### INTRODUCTION:

Anatomy deals with the structural organization of human body. Anatomy forms the basis for the practice of medicine. Students need core knowledge of human anatomy as they venture into the clinical domain. The department of anatomy is committed to provide quality education for students by its fully-equipped facilities. Cadaveric dissections & specimens, histology slides and VARIOUS models provide the ideal environment to learn anatomy during the 1<sup>st</sup> year of their course.

#### COURSE OBJECTIVES:

The objective of this subject is to provide an outline of anatomy to improve the students understanding the technical and diagnostic procedures used, with special emphasis on limbs, thoracic and abdominal viscera, osteology, neuro anatomy, endocrine system, basic radiology.

#### SYLLABUS

**Credits: Theory 02 & Practical 1**

**Hours: Theory 30 & Practical 30**

#### Theory:

UNIT	CONTENT	No. OF HOURS
I	The Nervous system Review Structure of neurons; CNS, ANS and PNS (Central, autonomic and peripheral) – Peripheral nerves, Brachial, Lumbar, Sacral plexus, Covering of brain, Surfaces and lobes of cerebrum white fibers of cerebrum, cranial nerves, brain stem, spinal cord - spinal nerves, functional areas of cerebral cortex, Ventricular system – formation, circulation, and drainage	9
II	Gastro Intestinal Tract Stomach morphology, blood supply, applied aspects Liver morphology, ligaments blood supply applied aspects, porta hepatitis Small and large intestine, appendix and appendicitis	5
III	The Excretory system & Reproductive system Morphology, relations and internal Structure of kidney, urethra Components of female reproductive system, Morphology of uterus and its supports Parts of Fallopian Tube, Layers of scrotum, Anatomy of Testis and its coverings Spermatic cord, Male urethra & its parts	7
IV	The Endocrine system Endocrine glands, Structure of Hypothalamus, Pineal Gland, Pituitary gland- Dwarfism Thyroid- Goiter, Parathyroid, Pancreas – Diabetes Mellitus, Adrenal glands, Gonads	5
V	The Sensory organs Receptors, Structure of skin, Eye - Anatomy of orbit and eyeball, Anatomy of Nose, Anatomy of ear, Anatomy of tongue	4

#### **Practical:**

<b>UNIT</b>	<b>CONTENT</b>	<b>No. OF HOURS</b>
I	Histology of Liver, Thyroid, Kidney	4
II	Liver, Stomach, Intestines	6
III	Spleen, Kidney	4
IV	Brain, Spinal cord	7
V	Bony Pelvis, Skull, Normal X- Rays, Surface markings	9

**COURSEOUTCOMES:**

1. This course is aimed to make the student to gain knowledge in basic anatomy of various regions like limbs, thoracic and abdominal viscera, osteology, neuroanatomy, endocrine system, basic radiology which provides foundation incompletion of the course.
2. Enable to understand about the Gastro Intestinal Tract, location, surfaces, lobes, relations, and blood supply of Liver.
3. Enables to understand about the Endocrine glands and explain the morphology and blood supply of Thyroid gland.

**References:**

1. Anatomy and physiology–Vijaya D Joshi, Ashalatha N Nandedkar, Sadhana S Mendhurwar
2. Anatomy and physiology- Indu Khurana and Arushi Khurana
3. Human anatomy & physiology for nursing –Mahindra Kumar Anand & Meena Verma
4. Understanding human anatomy &physiology- William Davis(McGraw-Hill)

**SEMESTER - II**  
**PHYSIOLOGY - II - 23PSGY2001**

UNIT	CONTENT	No. OF HOURS
I	<p><b><u>Muscle &amp; Nerve &amp; Neurology</u></b></p> <ul style="list-style-type: none"> <li>i. Describe the physiological structure of muscle tissue and its types.</li> <li>ii. Describe the parts of neuron and their functions, and the synapse and its function.</li> <li>iii. Describe the action potential, its basis, refractory period, latent period, etc. and neuromuscular transmission.</li> <li>iv. Describe briefly the autonomic nervous system and the functions and effects of the sympathetic and parasympathetic nervous systems.</li> <li>v. Describe the physiological anatomy of the brain and functions of different lobes.</li> <li>vi. Describe briefly the structure and functions of spinal cord.</li> <li>vii. Describe briefly the subdivisions of brain stem and their functions.</li> <li>viii. Describe briefly the special senses and their pathways – vision, audition (&amp; olfaction &amp; taste).</li> <li>ix. Describe the normal EEG.</li> <li>xi. Describe briefly the CSF formation, circulation, properties, composition and functions</li> </ul>	15
II	<p><b><u>Endocrine System</u></b></p> <ul style="list-style-type: none"> <li>i. Describe the physiological anatomy of Thyroid gland, functions and its applied physiology.</li> <li>ii. Describe the physiological anatomy of Adrenal gland, functions and its applied physiology.</li> <li>iii. Describe the physiological anatomy of Parathyroid gland, functions and its applied physiology</li> <li>iv. Describe the physiological anatomy of Pancreas, its functions and its applied physiology</li> <li>v. Describe the physiological anatomy of hypothalamus and the Pituitary gland, their functions and its applied physiology</li> </ul>	10
III	<p><b><u>Excretory System</u></b></p> <ul style="list-style-type: none"> <li>i. Describe the physiological structure of kidney and the nephron and its functions</li> <li>ii. Describe the GFR and factors affecting GFR</li> <li>iii. Describe the Substances absorbed and secreted from renal tubules</li> <li>iv. Describe the various Renal function tests</li> <li>v. Describe briefly the Urinary bladder and its functions and the physiology of micturition</li> </ul>	10
IV	<p><b><u>Skin, Bone &amp; Joints</u></b></p> <p><b><u>Skin</u></b></p> <ul style="list-style-type: none"> <li>i. Describe the Structure and functions of skin</li> </ul> <p><b><u>Bone &amp; Joints</u></b></p> <ul style="list-style-type: none"> <li>i. Describe the structure and formation of bone</li> <li>ii. Describe the structure and formation of cartilage</li> <li>iii. Describe the types of joints.</li> </ul>	10
V	<p><b><u>Reproductive System</u></b></p> <ul style="list-style-type: none"> <li>i. Describe the Physiology of Puberty</li> <li>ii. Describe the process of menstruation, normal menstrual cycle, menarche and menopause.</li> <li>iii. Describe briefly the process of Ovulation and methods of determination of ovulation</li> <li>iv. Describe briefly the normal physiology of pregnancy and mention the diagnostic tests for pregnancy and their physiological basis</li> <li>v. Describe briefly the functions of placenta and pregnancy diagnostic tests</li> <li>vi. List out the Contraceptive methods in male and female</li> <li>vii. Describe the Spermatogenesis</li> </ul>	15

## PRACTICALS

### **UNIT-I**

**6Hrs**

Demonstrate examination of heart—inspect JVP, localize apex beat, look for any abnormal pulsations, percuss cardiac dullness, auscultate heart for normal sounds

### **UNIT-II**

**6Hrs**

Demonstrate examination of respiratory system—inspect the chest for symmetry, movements, localize apical pulse and trachea, measure chest expansion, percuss the chest for lung resonance, liver dullness, auscultate lungs for breath sounds.

### **UNIT-III**

**6Hrs**

Demonstrate examination of the cranial nerves

Demonstrate examination of the motor system—bulk, tone, power of different groups of muscles, coordination and gait.

### **UNIT-IV**

**8Hrs**

Demonstrate the various sensory and motor reflexes—abdominal, plantar, biceps, triceps, supinator, knee and ankle

Demonstrate examination of sensory system—fine touch, pain, vibration

### **UNIT-V**

**4Hr**

Record an ECG

Measure weight and height and calculate Body Mass Index (BMI)

Assist in the recording of an EEG

Perform spirometry in a given individual and interpret the values

## REFERENCEBOOKS

1. Human Anatomy & Physiology for Nursing—Mahindra Kumar Anand & Meena Verma.
2. Understanding Human Anatomy & Physiology—William Davis(McGrawHill)
3. Anatomy & Physiology—Kaarna Muni Shekhar
4. Text book of Physiology for BDS students – Dr. Jain
5. Text book of physiology for BDS students—Dr.Sambulingam
6. Handbook of Human Physiology—Vidya Ratan
7. Concise Medical Physiology—Sujith K Choudhari



**SEMESTER – II**  
**SUBJECT: CLINICAL LABORATORY PRACTICES – 23PATH2011**  
**THEORY: HOURS- 45 CREDITS- 3**

UNIT	TOPICS	HOURS
I	<p>Infrastructure in the laboratories:</p> <p>a) Laboratory space: Reception, specimen collection, quality water supply, power supply, work area, specimen / sample / slide storage, cold storage, record room, washroom, biomedical waste room, fire safety, etc.</p> <p>b) Personnel in the laboratory: Qualifications as per NABL document.</p> <p>c) Equipment: Listing, cleaning, maintenance, SOP, verification of performance: Internal quality control.</p> <p>d) Reagents and materials: Purchase, maintenance, storage, use</p>	5
II	<p>Specimen Collection, storage, and Transport:</p> <p>General guidelines of collection, labeling, handling, transportation storage of specimens. Care in handling specimens. Accession list, Worksheet, Reporting test results, Specimen rejection record, Recording of Laboratory data, Maintenance of records</p>	10
III	<p>Standard operating Procedure:</p> <p>Definition, format, text of SOP, types of SOP</p>	10
IV	<p>Ethical considerations:</p> <p>Non – maleficence, beneficence, risk minimization, Institutional arrangement, ethical review, transmission of ethical values, voluntariness, compliance.</p>	5
V	<p>Quality assurance: Internal and external quality assessment</p> <p>Biowaste management in the laboratory</p>	15

**PRACTICAL/ CLINICAL: HOURS- 315CREDITS – 10.5**

UNIT	TOPICS	HOURS
I	Writing SOP of equipment maintenance and practical procedures done in the laboratory	80
II	Sample collection, labelling, storage, transportation	45
III	Document maintenance	45
IV	Ethical considerations	45
V	Internal / External quality control Biowaste management	100

**SEMESTER – III****Subject: Biochemistry-I (Basics in Biochemistry)****23BCHE1011****Hours: Theory – 30; Practical – 150****Credits: Theory – 2; Practical – 5**

UNITS	THEORY TOPICS	Number of Hours
		Theory
UNIT - 1	Concepts of Molecular weight, Atomic weight, Normality, Molarity, Standards, Atomic structure, Valency, Acids, Bases and Salts. Concepts of Acid base reaction and Hydrogen ion Concentration.	3
UNIT – 2	Principles of Photometry and Spectrophotometry, laws of absorption, wave length, turbidimetry, calibration, transmittance, absorption, standard, blank, Beer's law	3
UNIT - 3	Chemistry of Carbohydrates - Define and classify carbohydrates with examples, explain Glycosidic bond, Illustrate structure, composition, sources, properties and functions of Monosaccharides, Disaccharides, Oligosaccharides, and Polysaccharides. Reactions of Carbohydrates.	4
UNIT - 4	Chemistry of Amino-acids – Define and classify amino acids, Define peptides and explain peptide bonds, list the biologically important peptides. Vitamins –Definition, Classification of Vitamins according to solubility, List out the sources, Coenzyme forms, Functions, RDA, digestion, absorption, transport, deficiency and toxicity of individual Vitamins	10
UNIT - 5	Carbohydrate Metabolism– Glycolysis - Aerobic, Anaerobic, Citric acid cycle, Gluconeogenesis. Glycogen Metabolism - Glycogenesis, Glycogenolysis, Cori's Cycle. Hormonal regulation of Blood Glucose, Blood Glycosuria, Diabetes Mellitus, Glucose Tolerance test, Normal and Diabetic patterns	10

UNITS	PRACTICAL/CLINICAL	Number of Hours
UNIT – 1	a) Safety and precautions in the laboratory. b) Introduction to lab apparatus.	20
UNIT - 2	a) Maintenance of laboratory, glassware and apparatus. b) Chemical balance.	30
UNIT - 3	Preparation of normal solutions, molar solutions, % solutions, reagents, standards and dilution techniques.	30
UNIT – 4	Estimation of Blood Glucose Demonstration – Glucometer, Glucostrips	30
UNIT – 5	Identification of carbohydrates (glucose, fructose & sucrose)	40

**SUBJECT: Microbiology-I (General Microbiology & Immunology)****23MIBG1001****Hours: Theory - 30; Practical- 150****Credits: Theory -2; Practical/Clinical - 5**

<b>UNIT</b>	<b>TOPICS</b>	<b>HOURS</b>
I	<b>General Bacteriology and morphology of bacteria</b> <ul style="list-style-type: none"> <li>• History of Microbiology, Classification of Microorganisms</li> <li>• Microscopes</li> <li>• Bacterial morphology- Structure of Bacterial cell</li> <li>• Staining methods</li> <li>• Growth &amp; Nutrition of bacteria</li> <li>• Bacterial metabolism</li> <li>• Quality control in Microbiology</li> <li>• Laboratory safety</li> </ul>	6
II	<b>Bacterial culture and identification</b> <ul style="list-style-type: none"> <li>• Culture media and methods</li> <li>• Biochemical Tests</li> <li>• Molecular methods of Diagnosis: NAAT</li> <li>• Antibiotic sensitivity tests</li> <li>• Bacterial genetics</li> </ul>	4
III	<b>Infection and modes of transmission</b> <ul style="list-style-type: none"> <li>• Infection, source, Transmission</li> <li>• Virulence factors and toxins</li> <li>• Antimicrobial agents and resistance</li> </ul>	3
IV	<b>Sterilization and Disinfection</b>	3
V	<b>Immunity</b> <ul style="list-style-type: none"> <li>• Immunity: Types</li> <li>• Antigens, Antibody, Antigen–Antibody reaction</li> <li>• Specialized Techniques: RIA, ELISA, Immunofluorescence, Dot–Blot &amp; Rapid assays</li> <li>• Complement system, Structure and functions of immune system</li> <li>• Immune response</li> </ul> <b>Immune disorders</b> <ul style="list-style-type: none"> <li>• Hypersensitivity reactions</li> <li>• Autoimmunity, Tumor immunity, Transplantation immunity</li> <li>• Immunodeficiency: Primary, Secondary, AIDS</li> <li>• Immuno-prophylaxis and Immunohematology</li> </ul>	14

**PRACTICAL/CLINICAL**

<b>UNIT</b>	<b>TOPICS</b>	<b>HOURS</b>
I	Microscopes- types, operation	5
II	1. Hanging drop preparation 2. Staining: <ul style="list-style-type: none"> <li>• Simple staining</li> <li>• Gram staining</li> <li>• Ziehl Neelsen's staining</li> </ul>	70
III	Culture media- types, preparation and Inoculation methods, Aerobic & Anaerobic culture methods	25
IV	<ul style="list-style-type: none"> <li>• Biochemical reactions and interpretation -preparation of media for biochemical tests &amp; reagents</li> <li>• Antibiotic sensitivity methods</li> </ul>	35
V	Serological tests- Slide and tube, WIDAL and Latex agglutination- RF, ASO, CRP	15

**Subject: Pathology- I (Hematology & Clinical Pathology)**

**23PATH1001**

**Hours – Theory: 30; Practical: 150**

**Credits- Theory: 2; Practical: 5**

<b>UNITS</b>	<b>TOPICS</b>	<b>HOURS</b>
I	<b>HAEMATOLOGY:</b> <ul style="list-style-type: none"><li>• Hemopoiesis, stem cells, formed elements and their functions</li><li>• Normal constituents of blood, their structure and functions</li><li>• Blood collection</li><li>• Anticoagulants used in Hematology</li><li>• Normal values in Hematology Basic Hematological Techniques</li></ul>	5
II	<b>HAEMATOLOGY:</b> <ul style="list-style-type: none"><li>• RBC counts</li><li>• Hemoglobin estimation</li><li>• Packed cell volume &amp; ESR</li><li>• Calculation of Red cell indices &amp; Morphology of red cells and its significance</li><li>• WBC counts - Total and differential &amp; Morphology of leucocytes and its significance</li><li>• Absolute eosinophil count</li><li>• Platelet count- Morphology of platelets and its significance</li><li>• Preparation of blood films</li></ul>	7
III	<b>HAEMATOLOGY:</b> <ul style="list-style-type: none"><li>• Stains used in Hematology</li><li>• Preparation of buffy coat smears</li><li>• Reticulocyte count</li><li>• Bone marrow Aspiration – technique, preparation and staining of films<ul style="list-style-type: none"><li>○ Bone marrow biopsy</li></ul></li><li>• Preparation of glassware</li></ul>	5
IV	<ul style="list-style-type: none"><li>• Laboratory methods used in the investigation of deficiency anaemias.<ul style="list-style-type: none"><li>○ Iron study profile</li><li>○ B12 and Folate assay</li><li>○ Schilling test</li></ul></li><li>• Laboratory methods used in investigation of hemolytic anaemias<ul style="list-style-type: none"><li>○ Osmotic fragility</li><li>○ Sickling test</li><li>○ Estimation of Hb-F, Hb A2</li></ul></li><li>• Organization and quality control in hematology laboratory</li></ul>	6

V	<p><b>CLINICAL PATHOLOGY</b></p> <ul style="list-style-type: none"> <li>• Urine examination –Collection and preservation, Physical, Chemical and Microscopic examination</li> <li>• Examination of faeces for occult blood</li> <li>• Examination of body fluids - cell counts</li> <li>• Semen analysis</li> <li>• Sputum examination</li> </ul> <p><b>INSTRUMENTATION</b></p> <ul style="list-style-type: none"> <li>• Light microscope – Parts and its uses</li> <li>• Hematology equipments – ESR tube, PCV tube, Modified Neubauer chamber etc.,</li> <li>• Bone marrow aspiration and biopsy needles</li> <li>• Automation in hematology - Cell counters</li> <li>• Hb electrophoresis</li> <li>• HPLC</li> <li>• Automated urine analyzer</li> <li>• Computer assisted semen analysis</li> </ul>	7
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**PRACTICAL/CLINICAL**

UNIT	TOPICS	HOURS
I	<ul style="list-style-type: none"> <li>• Complete Urine Analysis</li> <li>• Body Fluids and miscellaneous samples</li> <li>• Cerebrospinal Fluid in Health &amp; Disease</li> </ul>	45
II	<ul style="list-style-type: none"> <li>• Semen analysis</li> <li>• Stool examination for Occult blood</li> </ul>	20
III	<ul style="list-style-type: none"> <li>• Peripheral blood smear – principle, preparation of smear, staining &amp; preparation.</li> <li>• Thin and thick smear preparation and staining</li> </ul>	35
IV	<ul style="list-style-type: none"> <li>• Reticulocyte count</li> <li>• ESR</li> <li>• Sickling test</li> </ul>	35
V	<p>Bone marrow smears</p> <ul style="list-style-type: none"> <li>• Staining</li> <li>• Examination</li> </ul>	15

**SEMESTER – IV**  
**Subject: Biochemistry-II (Metabolisms)**  
**23BCHE2001**

**Hours – Theory: 30; Practical: 150**  
**Credits: Theory – 2; Practical - 5**

UNITS	THEORY TOPICS	Number of Hours - 30
		Theory
UNIT - 1	Chemistry of Lipids – Fatty acids, Triglycerides, Cholesterol, Phospholipids.	5
UNIT – 2	Chemistry of Nucleic Acids - Show nucleotide composition and list functions of free nucleotides in body, Compare between DNA & RNA, explain structure and functions of DNA & RNA (tRNA, rRNA, mRNA)	4
UNIT – 3	Structure and functions of Heme Hemoglobin Catabolism	5
UNIT - 4	NPN substances – Urea, Uric acid & Creatinine significance and tests  Lipid Metabolism –Ketogenesis &Ketolysis Cholesterol synthesis Serum Lipoproteins in health and disease	11
UNIT – 5	1. Flame Photometry 2. Atomic absorption 3. Spectrophotometry	5

UNITS	PRACTICAL/CLINICAL	Number of Hours - 150
UNIT – 1	Estimation of Serum Creatinine & Creatinine Clearance	30
UNIT – 2	Estimation of Blood Urea Estimation of Uric acid	40
UNIT –3	Estimation of Cholesterol & HDL	30
UNIT – 4	Estimation of Triglycerides	20
UNIT – 5	Qualitative – NPN Substances	30

**SUBJECT: Microbiology-II (Systemic Bacteriology)**

23MIBG2001

**THEORY: HOURS- 30; CREDITS- 2**

UNIT	TOPICS	HOURS
I	<b>Gram positive cocci</b> <ul style="list-style-type: none"><li>• Staphylococcus</li><li>• Streptococcus</li></ul> <b>Gram negative cocci</b> <ul style="list-style-type: none"><li>• Neisseria</li></ul>	3
II	<b>Gram positive bacilli</b> <ul style="list-style-type: none"><li>• Corynebacterium</li><li>• Bacillus</li><li>• Anaerobic Bacteria: Clostridia, Non-sporing anaerobes</li><li>• Actinomycetes</li></ul>	4
III	<b>Gram Negative bacilli</b> <ul style="list-style-type: none"><li>• Enterobacteriaceae</li><li>• Non fermenting Gram-negative bacilli, Vibrio, Brucella, Haemophilus, Bordetella, Yersinia, Pasteurella, Francisella, Helicobacter</li></ul>	10
IV	<b>Other groups of bacteria</b> <ul style="list-style-type: none"><li>• Mycobacteria</li><li>• Spirochetes: Treponema, Borrelia, Leptospira</li><li>• Mycoplasma, Rickettsia, Chlamydia</li></ul>	5
V	<b>Systemic Bacteriology</b> <ul style="list-style-type: none"><li>• Urinary Tract infection</li><li>• Respiratory tract infection</li><li>• Diarrheal diseases and food poisoning</li><li>• CNS Infections</li><li>• Wound infection</li><li>• Blood stream infections</li><li>• Sexually transmitted infections</li><li>• Hospital acquired infections</li></ul>	8

**PRACTICAL: HOURS- 150; CREDITS- 5**

UNITS	PRACTICAL/ CLINICAL POSTING TOPICS	HOURS
I	Staining: <ul style="list-style-type: none"><li>• Gram staining</li><li>• ZN staining</li></ul>	10
II	Isolation and identification of bacteria from various clinical specimens	40
III	<ul style="list-style-type: none"><li>• Biochemical reactions</li><li>• Antibiotic susceptibility testing</li></ul>	80
IV	Serology tests- Slide and tube, WIDAL Precipitation- VDRL test	15
V	Common skin tests- Tuberculin	5

**Subject: Pathology-II (Histopathology & Cytology)**

**23PATH2001**

**Hours – Theory: 30; Practical: 150**

**Credits: Theory – 2; Practical – 5**

UNITS	TOPICS	HOURS
I	<p><b><u>HISTOPATHOLOGY:</u></b></p> <ul style="list-style-type: none"> <li>• Introduction to Histopathology:</li> <li>• Structure and functions of normal cell</li> <li>• Reception of specimens</li> <li>• Various fixatives – Mode of action, Indications, Preparation.</li> <li>• Grossing techniques</li> <li>• Steps of tissue processing and embedding.</li> </ul>	12
II	<p><b><u>CYTOLOGY:</u></b></p> <p>Exfoliative cytology and Interventional cytology</p> <p><b>i) Exfoliative Cytology:</b></p> <p>Techniques of collection &amp; Processing of samples in the Laboratory.</p> <ul style="list-style-type: none"> <li>• <b><u>Pap Smears:</u></b> <ul style="list-style-type: none"> <li>○ Lateral Vaginal wall smears</li> <li>○ Vaginal ‘pool’ or ‘vault’ smears</li> <li>○ Cervical smears</li> <li>○ Combined (fast) smears</li> <li>○ Triple smears (cervical-vaginal-endocervical smears)</li> </ul> </li> <li>• Endocervical and endometrial smears</li> </ul>	3
III	<ul style="list-style-type: none"> <li>• <b><u>Respiratory Tract:</u></b> <ul style="list-style-type: none"> <li>○ Selection of material and making smears</li> <li>○ Bronchial Aspiration (Washings)</li> <li>○ Bronchial Brushing</li> </ul> </li> <li>• <b><u>Urinary Tract:</u></b> <ul style="list-style-type: none"> <li>○ Collection and preparation of samples</li> <li>○ Urinary sediment Cytology</li> <li>○ Bladder Irrigation (Washings) Cytology</li> </ul> </li> <li>• Prostatic massage – Cytology</li> </ul>	5
IV	<ul style="list-style-type: none"> <li>• <b><u>Body Fluids:</u></b> <ul style="list-style-type: none"> <li>○ Effusions in body cavities</li> <li>○ Fluids of small volume.</li> <li>○ Effusions – Ascitic, pleural, pericardial, synovial fluid</li> <li>○ Cerebrospinal Fluid (CSF) - Normal CSF, CSF in diseases.</li> </ul> </li> <li>• <b><u>Fixation and Fixatives in Cytology:</u></b> <ul style="list-style-type: none"> <li>○ Routine Fixatives</li> <li>○ Coating Fixatives</li> <li>○ Special purpose fixatives</li> <li>○ Preservation of fluid samples</li> </ul> </li> </ul>	5



	<ul style="list-style-type: none"> <li>• <b><u>Staining of smears:</u></b> <ul style="list-style-type: none"> <li>○ Papanicolaou's stain – Principle, preparation of reagents and procedure</li> <li>○ H &amp; E stain - Principle, Preparation of reagents and procedure</li> <li>○ Romanowsky stains - Leishman's, May Grunwald-Giemsa (MGG) &amp; Wright's stains.</li> </ul> </li> <li>• <b><u>Interventional Cytology:</u></b> <ul style="list-style-type: none"> <li>○ Fine Needle Cytology</li> <li>○ Imprint cytology</li> <li>○ Crush smear cytology</li> <li>○ Biopsy sediment cytology</li> </ul> </li> </ul>	
V	<ul style="list-style-type: none"> <li>• <b><u>Body Fluids:</u></b> <ul style="list-style-type: none"> <li>○ Effusions in body cavities</li> <li>○ Fluids of small volume.</li> <li>○ Effusions – Ascitic, pleural, pericardial, synovial fluid</li> <li>○ Cerebrospinal Fluid (CSF) - Normal CSF, CSF in diseases.</li> </ul> </li> <li>• <b><u>Fixation and Fixatives in Cytology:</u></b> <ul style="list-style-type: none"> <li>○ Routine Fixatives</li> <li>○ Coating Fixatives</li> <li>○ Special purpose fixatives</li> <li>○ Preservation of fluid samples</li> </ul> </li> <li>• <b><u>Staining of smears:</u></b> <ul style="list-style-type: none"> <li>○ Papanicolaou's stain – Principle, preparation of reagents and procedure</li> <li>○ H &amp; E stain - Principle, Preparation of reagents and procedure</li> <li>○ Romanowsky stains - Leishman's, May Grunwald-Giemsa (MGG) &amp; Wright's stains.</li> </ul> </li> </ul>	5

### PRACTICAL/CLINICAL

UNIT	TOPICS	HOURS
I	<ul style="list-style-type: none"> <li>• Tissue Processing , Embedding, Block preparation , Use and care of Microtome and Microtome knives</li> </ul>	70
II	H & E staining	20
III	<ul style="list-style-type: none"> <li>• Wet film preparation and Fixation,</li> <li>• Staining (H&amp;E, Pap, MGG and Shorr) of vaginal smears, cervical smears and sputum</li> </ul>	25
IV	FNAC (Fine Needle Aspiration Cytology) - preparation of smears and staining.	25
V	<b>Instrumentation</b> Balances, water bath, Hot air oven, Tissue weighing machines, Tissue Processor, Microtomes, Knives, Knife sharpener, Pap smear kit, Instruments for grossing	10

**SEMESTER – V****Subject: Biochemistry-III (Clinical & Applied Biochemistry)****23BCHE3001****Hours – Theory: 30; Practical: 150****Credit Hours: Theory – 2; Practical - 5**

<b>UNITS</b>	<b>THEORY TOPICS</b>	<b>Hours</b>
UNIT - 1	Enzymes - Definition, Classification, Co-enzymes, Co-factors, inhibitors effecting enzyme activity, units of measurement, Iso-enzymes, normal values of different serum enzymes and their variation in diseases.	7
UNIT – 2	Plasma Proteins – Functions of Plasma proteins & Biochemical changes in disease, Fractionation techniques - Interpretation. Immunoglobulins - Structure and functions	6
UNIT – 3	Protein Chemistry - Classification, structure and functions of Proteins. Protein Metabolism - Define Catabolism of Amino acids- transamination, deamination, Illustrate fate of ammonia, transport of ammonia, Urea cycle Outline the specialized products formed from amino acids	3 8
UNIT –4	Sample Collection, Anticoagulants. Preservation and Preparation of Protein free filtrate. Collection of 24 hrs Urine for analysis	4
UNIT –5	Automation - Auto-Analyser	2

<b>UNITS</b>	<b>PRACTICAL/CLINICAL</b>	<b>Hours</b>
UNIT – 1	Estimation of Total Serum proteins	20
UNIT – 2	Estimation of Albumin and A/G ratio	20
UNIT – 3	Estimation of Glucose in Cerebro Spinal Fluid Estimation of Proteins in Cerebro Spinal Fluid	20 20
UNIT –4	Reactions of proteins and Identification of Proteins, Albumin, Gelatin, Casein	40
UNIT – 5	Demonstration – a) Autoanalyser b) Sample Collection c) Preservation	30

**Subject: Microbiology-III (Virology & Mycology)**

**23MIBG3001**

**Theory: Hours- 30; Credits- 02**

**Practical - Hours- 150; Credits- 05**

<b>UNITS</b>	<b>TOPICS</b>	<b>HOURS</b>
I	<b>General Virology and overview of viral infections</b> <ul style="list-style-type: none"><li>• General Properties &amp; Classification of Viruses</li><li>• Virus -host interaction, Bacteriophage</li></ul>	2
II	<b>RNA viruses</b> <ul style="list-style-type: none"><li>• Poliomyelitis, Coxsackie virus, Rhino viruses, Influenza, Rabies, Arboviruses, Measles, Mumps, Rubella, HIV, Rotavirus</li></ul>	12
III	<b>DNA viruses</b> <ul style="list-style-type: none"><li>• Smallpox, Herpes simplex, Varicella zoster, CMV, EBV, Adeno viruses, Hepatitis viruses</li></ul>	7
IV	<b>General Mycology and overview of fungal infections</b> <ul style="list-style-type: none"><li>• Fungi–Characteristics</li><li>• Classification</li><li>• Lab Diagnosis</li></ul>	2
V	<b>Superficial, Subcutaneous mycosis and Systemic mycosis</b>	3
	<b>Opportunistic fungi</b>	4

**PRACTICAL: HOURS- 150; CREDITS- 5**

<b>UNITS</b>	<b>TOPICS</b>	<b>HOURS</b>
I	Preparation, identification, and interpretation of samples from skin, hair and nail, sputum, vaginal secretions, oral secretions for the diagnosis of fungal infections	10
II	KOH mount, Tease mount	20
III	Fungal culture techniques including slide culture	30
IV	Rapid Tests for HIV, HBsAg & HCV	10
	ELISA	30
V	Nucleic acid amplification techniques (NAAT)	50

**Subject: Pathology-III (Advanced Techniques)**

**23PATH3001**

**Hours – Theory: 30; Practical: 150**

**Credit Hours: Theory – 2; Practical – 5**

**Theory:**

<b>UNITS</b>	<b>TOPICS</b>	<b>HOURS</b>
I	<b><u>HISTOPATHOLOGY:</u></b> <ul style="list-style-type: none"><li>• Section cutting.</li><li>• Mode of preparation and theory of Haematoxylin &amp; Eosin staining</li><li>• Various aspects of mounting and staining the slides</li><li>• Decalcification and various methods</li><li>• Use of Polarizing Microscope, Phase contrast Microscope and Fluorescent Microscope</li></ul>	8
II	<b><u>IMMUNOHISTOCHEMISTRY:</u></b> <ul style="list-style-type: none"><li>• Introduction, Overview and Applications of Immunohistochemistry.</li></ul>	4
III	<b><u>IMMUNOCYTOCHEMISTRY:</u></b> <ul style="list-style-type: none"><li>• Introduction and Basic concepts of Immunocytochemistry</li><li>• Immunocytochemical methods (immunoperoxidase and immunoalkaline phosphatase etc).</li></ul>	3
IV	<b><u>SPECIALSTAINS:</u></b> <ul style="list-style-type: none"><li>• Mucicarmine, P.A.S., Reticulin stain</li><li>• Oil Red“O”, Alcian Blue, Congo Red, Verhoeff’s stain</li><li>• Mallory’s Phosphotungstic Acid Hematoxylin stain(PTAH), Van Gieson stain , Masson’s Trichrome stain</li><li>• AFB Staining – for tissue sections of Tuberculosis and Leprosy</li></ul>	7
V	<b><u>ADVANCED TECHNOLOGIES:</u></b> <ul style="list-style-type: none"><li>• Flow cytometry</li><li>• Cytogenetics – Karyotyping, FISH, PCR</li></ul> <b><u>CYTOLOGICAL EXERCISE:</u></b> <ul style="list-style-type: none"><li>• Sex chromatin – Buccal smear examination</li></ul>	8

**PRACTICAL/CLINICAL**

<b>UNIT</b>	<b>TOPICS</b>	<b>HOURS</b>
I	<ul style="list-style-type: none"><li>• Demonstration of Tissue Section cutting</li></ul>	20
II	<ul style="list-style-type: none"><li>• H &amp; E staining</li><li>• Immunohistochemistry staining – Demonstration</li></ul>	30
III	<ul style="list-style-type: none"><li>• Buccal smear staining and examination</li></ul>	20
IV	<b>SPECIAL STAINS</b> <ul style="list-style-type: none"><li>• PAS , Masson trichrome, Alcian blue</li><li>• Congo red, Reticulin stain</li><li>• AFB stain</li></ul>	70
V	<b><u>INSTRUMENTATION</u></b> <ul style="list-style-type: none"><li>• Rotary microtome, Grossing station, Antigen retrieval, Flow cytometry</li><li>• FISH, RT PCR</li></ul>	10

**SEMESTER – VI****Subject: Biochemistry IV (Recent Techniques in Biochemistry)****23BCHE3011****Hours – Theory: 30; Practical: 150****Credit Hours: Theory – 2; Practical - 5**

UNITS	THEORY TOPICS	Number of Hours
		Theory
UNIT – 1	Mineral Metabolism – Classification, Sources, RDA, Digestion and transport of Minerals. List out the functions and clinical disorders of individual minerals – Calcium, Phosphate, Iron, Magnesium, Fluoride, Selenium, Sodium, Potassium, Chloride & Copper.	8
UNIT – 2	Acid –Base Balance - Define acids, base and pH. Define buffers and describe buffer systems of the body, Bicarbonate buffer system. Discuss the role of lungs and kidneys in acid-base balance, Outlines of Acid base disorders.	8
UNIT – 3	Organ function tests – RFT, LFT, TFT	4
UNIT – 4	Electrophoresis and Chromatography techniques	4
	Outlines of Accuracy, Precision and Quality control	3
UNIT – 5	Chemistry, Formation and Analysis of Renal Calculi and Gall Stones	3

	PRACTICAL/CLINICAL	Number of Hours - 150
UNIT – 1	Estimation of Calcium	20
UNIT – 2	Estimation of Total Serum Bilirubin. Direct and Indirect	30
UNIT – 3	Determination of SGOT	20
	Determination of SGPT	20
UNIT – 4	Qualitative – Abnormal Constituents of Urine	30
UNIT – 5	Demonstration – a) ABG b) Estimation of T3, T4, TSH, c) Serum Iron and Iron binding capacity d) Determination of ALP,LDH, Amylase	30

**SUBJECT: Microbiology – IV (Parasitology)**  
**23MIBG3011**  
**THEORY: HOURS- 30; CREDITS- 2**

UNITS	TOPICS	HOURS
I	<b>General Parasitology and overview of parasitic infections</b> <ul style="list-style-type: none"> <li>• Types of parasites, classification of protozoa and Helminths.</li> <li>• Collection, preservation, and processing of stool specimen</li> <li>• Examination of blood parasites:Methods</li> </ul>	4
	<b>Role of Arthropods in disease transmission</b>	1
II	<b>Protozoa</b> <ul style="list-style-type: none"> <li>• Entamoeba histolytica</li> <li>• Trichomonas vaginalis</li> <li>• Giardia lamblia</li> <li>• Hemoflagellates (in brief)</li> <li>• Malarial parasites</li> <li>• Opportunistic protozoan infections in AIDS</li> </ul>	8
III	<b>Cestodes</b> <ul style="list-style-type: none"> <li>• D. latum</li> <li>• E.granulosus</li> <li>• T.saginata and T.solium</li> <li>• H.nana and H.diminuta</li> </ul>	4
IV	<b>Trematodes</b> <ul style="list-style-type: none"> <li>• Blood flukes</li> <li>• Liver flukes</li> <li>• Lung flukes</li> </ul>	5
V	<b>Nematodes</b> <ul style="list-style-type: none"> <li>• Ascaris lumbricoides</li> <li>• Ankylostoma duodenale</li> <li>• Necator americanus</li> <li>• Strongyloidesstercoralis</li> <li>• Trichuris trichiura</li> <li>• Enterobius vermicularis</li> <li>• Dracunculus medinensis</li> <li>• Wuchereriabancrofti</li> </ul>	8

**PRACTICAL/CLINICAL HOURS- 150**  
**CREDITS- 5**

UNITS	TOPICS	HOURS
I	Microscopic examination of faeces <ul style="list-style-type: none"> <li>• Saline mount</li> <li>• Iodine mount preparation</li> </ul>	20
II	Modified acid-fast staining	20
III	Stool Concentration techniques	20
IV	Rapid tests for the diagnosis of malaria	20
	Peripheral smear for parasites	20
V	Processing of samples for various microbiological investigations & documentation	50

**Subject: Pathology – IV (Blood Banking)**

**23PATH3011**

**Hours – Theory: 30; Practical: 150**

**Credit Hours: Theory - 2; Practical - 5**

**Theory:**

UNITS	TOPICS	HOURS
I	<b><u>BLOOD BANKING:</u></b> <ul style="list-style-type: none"><li>• ABO Blood Group System.</li><li>• Rh typing and weaker variants in Rh system.</li><li>• Subgroups and weaker variants of A and B: Bombay Phenotype.</li><li>• Coomb's test – Direct and Indirect</li><li>• Blood grouping and compatibility test (cross matching) in blood bank.</li><li>• Collection and processing of donor blood.</li><li>• Preservation of blood, blood components and its application in blood banking.</li></ul>	<b>10</b>
II	<ul style="list-style-type: none"><li>• Screening tests for blood transfusion</li><li>• HLA Antigens and their significance in Blood transfusion.</li><li>• Blood transfusion reactions and Investigations of transfusion reactions</li><li>• Blood Bank Administration</li></ul>	<b>3</b>
III	<b><u>BLEEDING DISORDERS</u></b> <ul style="list-style-type: none"><li>• Mechanism of coagulation, Collection and anticoagulants used in coagulation studies</li><li>• Bleeding time and clotting time.</li><li>• Platelet count, Platelet function tests.</li><li>• Prothrombin time (PT), Activated partial thromboplastin time (APTT), Thrombin time, Other coagulation studies(factor)</li></ul>	<b>7</b>
IV	<b><u>FROZEN SECTIONS AND CRYOSTAT</u></b> <ul style="list-style-type: none"><li>• Freezing Microtome and Frozen section technique.</li></ul> Cryostat: <ul style="list-style-type: none"><li>• Types and Operation of Cryostat</li><li>• Cryostat Cut Sections and staining.</li></ul>	<b>5</b>
V	<b><u>MUSEUM TECHNIQUES</u></b> <ul style="list-style-type: none"><li>• Preparation of specimens for mounting,</li><li>• Methods of mounting,</li><li>• Preparation of mounting solutions and colour maintenance.</li></ul>	<b>5</b>



**PRACTICAL/CLINICAL**

<b>UNIT</b>	<b>TOPICS</b>	<b>HOURS</b>
I	<ul style="list-style-type: none"><li>• Blood grouping</li><li>• Cross matching</li></ul>	30
II	<ul style="list-style-type: none"><li>• Screening tests for blood transfusion – HIV, HbsAg, Malaria, syphilis, HCV</li></ul>	30
III	<ul style="list-style-type: none"><li>• Bleeding time (BT), Clotting time (CT)</li><li>• PT and APPT demonstration – Manual and automated</li></ul>	30
IV	<b><u>MOUNTING OF MUSEUM SPECIMENS</u></b> <ul style="list-style-type: none"><li>• Routine mounting of specimens</li><li>• Mounting in glass jars</li><li>• Special methods of mounting</li></ul>	50
V	<b><u>INSTRUMENTATION</u></b> <ul style="list-style-type: none"><li>• Freezing Microtome, Cryostat.</li><li>• Automation in blood banking</li><li>• Application of Computers in Pathology</li></ul>	10